

# MONTHLY WEATHER REVIEW,

## NOVEMBER, 1877.

WAR DEPARTMENT,

Office of the Chief Signal Officer,

DIVISION OF

TELEGRAMS AND REPORTS FOR THE BENEFIT OF COMMERCE AND AGRICULTURE.

### INTRODUCTION.

The present REVIEW for the month of November depends upon all official data received up to the 15th of December from the Canadian Meteorological Office; the United States Navy; the Army Post Surgeons; the Voluntary and Regular Observers of the United States Signal Service. The most interesting features of the month have been: *First*, The three severe storms that occurred the first nine days of the month. *Second*, The excess in pressure in the Middle States, Lower Lake region and New England. *Third*, The general excess of rain-fall, except in the Northwest. *Fourth*, The general continuation of high temperature, except in the Gulf States. *Fifth*, The unusually large number of Cautionary Signals displayed. *Sixth*, The unusually large number of earthquakes.

### BAROMETRIC PRESSURE.

*In General.*—The general distribution of atmospheric pressure for the month is shown by the isobars on chart No. II, from which it appears that the area of highest pressure, or that included within the isobar of 30.10, includes the Gulf, South Atlantic and Middle Atlantic States. The area of lowest pressure on the chart lies in Dakota. The general distribution of pressure agrees very nearly with the mean since 1872, with the exception of a marked excess in the Middle and New England States. The pressure on the Pacific coast has been about the mean.

*Barometric Ranges.*—The general range of pressure (as reduced to sea-level) is shown by the following table, which gives the highest and lowest pressures at the centre of high and low areas respectively, and from which it will appear that for the whole country a range of 1.76 inches has been recorded:

LOW AREAS.				HIGH AREAS.			
No.	Location.	Date.	Minimum Pressure.	No.	Location.	Date.	Maximum Pressure.
I	Father Point.....	Nov. 3rd, 7:35 a. m.....	28.92	I	Nova Scotia.....	Nov. 2nd, 7:35 a. m.....	30.16
II	St. Paul.....	Nov. 1st, 11 p. m.....	29.50	II	Middle States.....	Nov. 4th, 7:35 a. m.....	30.48
III	Cape Breton.....	Nov. 6th, 4:35 p. m.....	29.48	III	Lower Missouri valley..	Nov. 5th, 7:35 a. m.....	30.62
IV	Bismarck.....	Nov. 6th, 11 p. m.....	29.50	IV	Indian Territory.....	Nov. 10th, 7:35 a. m.....	30.60
V	Toledo and Detroit.....	Nov. 8th, 4:35 p. m.....	29.47	V	New England.....	Nov. 20th, 11 p. m.....	30.68
VI	Parry Sound.....	Nov. 16th, 4:35 p. m.....	29.82	VI	Indian Territory.....	Nov. 29th, 11 p. m.....	30.59
VII	Cape Breton.....	Nov. 16th, 7:35 a. m.....	29.33				
VIII	Lynchburg.....	Nov. 23rd, 11 p. m.....	29.63				
IX	Bismarck.....	Nov. 20th, 4:35 p. m.....	29.55				
X	Bismarck.....	Nov. 23rd, 4:35 p. m.....	29.31				
XI	Esplanada.....	Nov. 27th, 4:35 p. m.....	29.22				
XII	Halifax.....	Nov. 29th, 11 p. m.....	29.11				

The local barometric ranges have been as follows: *Large Ranges.*—Albany, 1.51; Burlington, 1.54; New Haven and Eastport, 1.46; Rochester, 1.44; Buffalo, 1.45; Boston, 1.42. *Small Ranges.*—Sacramento, 0.52; Santa Fe, 0.51; San Francisco, 0.56; Los Angeles, 0.45; Denver, 0.66; Jacksonville, 0.61.

*Areas of High Pressure in General.*—The areas of high pressure occurring during the month of November have most frequently first appeared on the Pacific coast, and then been transferred over the Rocky Mountains. A few seem to have entered the United States in the plateau east of the Rocky Mountains, and west of the Mississippi river, in rear of depressions moving over the Northwest. In detail, they are as follows:

No. I.—On the morning of the 1st the highest pressure was in the Middle States. This high area moved slowly in a northeasterly direction into Nova Scotia, and disappeared on the 2d beyond that coast, in advance of depression No. I, then moving over the Lake region.

No. II.—The pressure rose on the Pacific coast during the last days of October. On the morning of the first of November the barometer was the highest above the normal pressure in Oregon. This high area moved rapidly, with northwesterly winds, in a southeasterly direction, closing up the rear of depression No. I; and on the 2d the highest barometer was transferred to Texas, giving rise to a light "norther." It then moved slowly over the Atlantic coast States, accompanied by northerly winds, veering to southerly, in advance of depression No. III, until the 5th instant, when it disappeared beyond Nova Scotia.

No. III.—The barometer rose slowly in the Northwest and Manitoba on the 2d and 3d, in rear of low area No. II, but it remained nearly stationary in position until depression No. III, then entering the Lower Missouri valley, had advanced east of the Mississippi river. On the 5th the barometer rose rapidly, with cold northwesterly winds, from Minnesota to the Gulf, giving rise to a severe "norther" in Texas on that and the succeeding day. This high area was slowly transferred to the east, and on the 6th and 7th occupied the Middle States and New England. On those days clear and cold weather prevailed in the Atlantic States, with northerly winds. On the 8th the highest pressure moved into Nova Scotia, where it rapidly disappeared, with southerly winds, in advance of depression No. V, then progressing in a northeasterly direction over the Lake region.

No. IV.—On the 6th and 7th the pressure rose on the Pacific coast, in rear of the depression charted as Nos. (IV and V.) On the 8th the rise covered the region east of the Rocky Mountains, and west of the Mississippi river, giving rise in Texas to a light "norther." On the 8th and 9th the highest pressure was slowly transferred from the Northwest to the West Gulf States. On the 9th and 10th the prevailing winds were northerly, except in the Upper Lake region and Northwest, where they were southerly. On the 10th, 11th, and 12th, the highest pressure, in the mean time slowly diminishing, was transferred from the West Gulf States to the Southern States. On the 13th and 14th this high area extended itself along the Atlantic States, giving rise to northerly winds veering to southerly, as it moved beyond the coast, in advance of depression No. VII. On the 15th the highest pressure was again found in the South and Southwest, in consequence of the movement of the storm, mentioned above, over the Lake region. On the 16th this area remained central in the Gulf States, and on the 17th it was merged into high area No. V.

No. V.—On the 16th the barometer rose rapidly in Manitoba and the Northwest, in rear of depression, No. VII. On the 17th the rise extended, with cold northerly winds, from Minnesota to the Gulf and South Atlantic States. On the 18th the highest pressure appeared in the Lake region, and northerly winds, with clear weather, prevailed to the Atlantic and Gulf coast. On the 19th and 20th this high area moved, with rising barometer, into the St. Lawrence valley and New England, this region being nearly circumscribed by the remarkably high isobar of 30.60. On the 21st the highest barometer was transferred to Nova Scotia. The barometer remained highest in Nova Scotia, with slowly diminishing pressure, until the 26th, attended in New England and the Middle States by high northeasterly winds. On the 27th and 28th this high area slowly disappeared, with southeasterly winds, in advance of depression No. XI, then moving from the Lake region into Canada.

No. VI.—On the 25th and 26th the barometer rose rapidly on the Pacific coast, and on the 26th and 27th this high pressure extended over the country west of the Mississippi river, giving rise on the 28th and 29th to a severe "norther" in Texas. On the 29th and 30th the highest barometer was transferred from the Northwest to the Gulf States, where, on the midnight of the 30th, unusually cold northerly winds and clear weather prevailed.

*Areas of Low Pressure in General.*—Twelve areas of low pressure, with their charted tracks, are described in the following list: One of which, (No. XII,) occurring during the last days of the month probably originated in the tropics near the Leeward Islands and curving near latitude 30° pursued a track nearly parallel to the Gulf Stream. Of the other depressions the great majority have first appeared on the Pacific Coast, seemingly entering the United States in either Oregon or Washington Territory and have then been traced, approximately, in this Office, over the Rocky Mountain region by means of charts of normal pressures. Depressions Nos. VI, X and XI are not charted to the Pacific Coast, but they were preceded by a remarkable fall of pressure on the North Pacific Slope, which fall was traceable into the plateau east of the Rocky Mountains, but so many reports were missing from

that region that it was not considered expedient to attempt to chart their tracks. In examining the chart of the tracks of areas of low barometer for this month, it is noticeable that of the three depressions that entered the Pacific coast near Oregon, all apparently pursued a southeasterly course over the Pacific slope until east of the Rocky Mountains, where warm and moist southerly winds were blowing from the Gulf of Mexico; the same features belong to depressions Nos. VI and XI, as far as charted. Attention was directed to this subject, because in Europe it has been noted that storm-centres moving from the ocean, frequently enter that continent with a track to the north of east, but as they progress into the interior, and as the country becomes more arid or destitute of moisture, there is a tendency for storm-centres to be diverted to the south of east, with southerly winds blowing from the Black and Caspian seas. In two instances there appear to have been formed east of the Rocky Mountains double, independent depressions from the single depressions entering the Pacific slope. (See Nos. IV and V, and Nos. X and XI.) Of these Nos. IV and X moved over the Northwest, encountering the moist, southerly winds blowing up the Missouri and upper Mississippi valleys, and Nos. V and XI entered the Indian Territory, and there met the moist, south winds from the Gulf.

No. I.—On the morning of the 1st the pressure was lowest in Texas, where the mercury had been falling rapidly for twenty-four hours. The centre of the depression was then situated in a trough of low pressure, extending from the West Gulf to Manitoba, while, at the same time, there was a high pressure, central in the Middle States, and another high barometer in the Rocky Mountain region, advancing in a southeasterly direction, with brisk and cold northwest winds; heavy rain was falling in Texas and the Indian Territory. On the 1st the storm-centre moved rapidly in a northeasterly track, traversing the Ohio valley, and, on the morning of the 2nd, occupied the Lower Lake region. The storm had developed by this time remarkable energy, and was the severest that has visited the lakes this autumn. The general pressure in the Lower Lake region was below 30.20, and the winds nearly reached hurricane violence. On the 2nd, the storm centre moved up to the St. Lawrence valley, and on the 3rd disappeared beyond the limits of the map in the Gulf of St. Lawrence, the pressure at Father Point falling below 29.00. Abundant rain fell in the east and south quadrants, which was rapidly followed by colder, clearing weather after the wind veered to westerly.

No. II.—In the description of the previous storm, it was stated that on the morning of the 1st a trough of low pressure extended from the West Gulf to Manitoba. In this trough a secondary storm-centre was developed in Minnesota, which moved in an easterly path over Wisconsin, and on the 2nd became merged in the depression charted as No. I; regarded as an independent storm, it displayed little energy, and its influence was slight beyond the region of the track charted for its centre.

No. III.—On the 2nd the pressure fell in Oregon and Washington Territory. The centre of the depression, moving in a southeasterly path, crossed the Rocky Mountains on the 3rd. On the morning of the 4th, the lowest pressure was in Kansas and Nebraska; it then pursued an easterly track and by midnight of that day a trough of low barometer extended, from western Texas to Michigan. At that time there was a high barometer on the Atlantic coast, and a high and rapidly rising pressure in Manitoba and Dakota; into the trough referred to above were blowing warm southerly and cold northerly winds. The thermometric gradient from the middle line of this trough to the northern boundary being quite "steep." On the 5th the storm traversed with an easterly path the Lake region and then crossed to the New England coast. In its progress the barometer continually fell at the centre of the depression, and the storm developed increasing energy. On the afternoon of the 6th it moved out to sea beyond Nova Scotia. This storm, though not in general so energetic as No. I, still was more severe on the North Atlantic coast. Copious rain fell during its passage, most abundantly in the south quadrant, and after the veering of the winds to colder westerly. This storm was followed by rapidly clearing weather, and colder northwest winds.

Nos. (IV and V).—On the 5th, the barometer fell in Oregon and Washington Territory, and on that day there seems to have been a severe gale on that coast; the centre of the depression moved in a northeasterly track, and on the morning of the 6th, appears to have been in Utah; during the day, this low area seems to have divided into two separate depressions, for at the afternoon report, there appears a centre of low barometer in Wyoming Territory north of Cheyenne, and another in Colorado, southeast of Denver. The north track is charted as No. IV. This depression moved on the 6th and 7th, over Minnesota and entered Canada north of Lake Superior. It possessed no special features worth describing. The south track is charted as No. V. On the 6th and 7th, the depression moved slowly to the south of east, and at midnight of the last, date, the lowest barometer was central in Missouri. At that time there was a high barometer on the Middle Atlantic coast, and the mercury was rising rapidly in the extreme northwest. By the afternoon of the 8th, the storm had moved with greatly increased energy into the Lower Lake region. At this time the barometer was falling rapidly in the Middle and New England States, and rising fast in the Northwest; during the night the lowest pressure remained nearly central in the Lower Lake region, while the storm slowly extended itself to the east. On the 9th, the centre of the depression moved over New England

and Nova Scotia, and then passed beyond the Atlantic coast. In the Lake region the rain-fall and dangerous winds appear about equally in all the quadrants of the depression but along the Atlantic coast, the rain and high winds are generally confined to the east and south quadrants. The 9th was remarkable for the high temperature that prevailed in the Middle Atlantic States after the passage of the storm to the east. The detention of the centre of the depression in the Lower Lake region during the night of the 8th and 9th appears to have prevented that sudden fall of temperature that is so marked a feature of the storms of the United States, after the passage of the lowest pressure over any place. In this connection it is noted that at the morning report of the 9th an unusually "steep" thermometric gradient is shown in the St. Lawrence Valley and Lower Lake Region. On the south side the temperatures were Rochester, 52°, Oswego, 54°, Burlington, Vt., 59°, Chatham, N. B., 55°, and on the north side Toronto, 39°, Kingston, 39°, Montreal, 39°, Quebec, 36°, Father Point, 34°. During the day of the 9th the weather in the Middle States was mild and fair, but as the cold wave moved slowly to the south, entire cloudiness was caused by the sudden fall of temperature in a moist atmosphere, and at the afternoon report of the 10th threatening rainy weather and high northerly winds prevailed over the Middle Atlantic States, with a general fall in temperature, exceeding 15° in twenty-four hours.

No. VI.—On the 10th there was a marked fall of pressure on the Pacific coast near Oregon, with a rise on the 11th, but so many reports of that date are missing that the track of this depression cannot be charted until the afternoon of the 12th, when the lowest pressure was in Utah, to the north of Salt Lake. The center of the depression moved slowly to the southeast until the midnight of the 13th, when the lowest barometer was in the Indian Territory, nearly south of Fort Dodge, Kansas. On the 14th the depression moved into the Upper Mississippi valley, showing only slight energy. On the 15th the low area moved slowly to the northeast, with diminishing energy and with the barometer continually rising at the center of the depression. On the 16th it moved into the Gulf of St. Lawrence. This depression was accompanied by light precipitation and the winds were seldom high.

No. VII.—While the low area just described, was central near Lake Huron, there appeared on the afternoon of the 15th, a slight depression in Dakota which on the 16th moved in an easterly track over the Northwest and Wisconsin, and on the 17th and 18th pursuing the same course, passed north of the Lower Lakes and thence moved over New England into Nova Scotia.

This storm which continually increased in energy, had for a great part of its track, its centre north of our Stations, it was accompanied by light precipitation, but the winds in the Lake region and on the Atlantic coast were in general dangerous. It was followed by rapidly rising barometer.

No. VIII.—On the 15th the pressure fell in Oregon and Washington Territory and the report of disasters show that the storm must have been very severe on that coast. On the 16th the centre of the depression moved in a southeasterly track into Utah. On the 17th, inclining more to the south, the course of the centre was into New Mexico, west of the Rio Grande. On the 18th the depression moved slowly to the east, into Western Texas. On the 19th, the storm increasing very rapidly in energy, moved into Middle Texas. On the 20th the storm centre moved to the northeast into Arkansas. At the end of this day the depression was situated in a trough of low pressure extending from Manitoba to the Gulf. On the 21st, there were two distinct depressions formed from this trough, one situated in Minnesota (No. IX) and the other, the one now being described being in the South Atlantic States. On the 22d the storm remained nearly stationary, the center of lowest pressure being "out at sea" a short distance east of the Georgia and South Carolina coast. On the 23d the storm moved in a northerly track over the Carolinas. On the 24th the depression moved in a path slightly to the west of north. At the morning report of the 25th the center of low barometer was in southern Michigan, and after this report this storm seems to have been merged in the new storm-centre, No. XI, then entering Missouri and Illinois. It was during the night of the 23rd and 24th, when the centre of this storm was in West Virginia, that the U. S. steamer *Huron* was wrecked on the North Carolina coast, at Nag's Head, fifty miles north of Cape Hatteras. A southeasterly wind was blowing, with a heavy southeast swell, at the scene of this disaster.\* This storm developed more energy on the 23rd and 24th than at any other part of its course; from the morning of the 22nd until it becomes merged with low area No. XI, the direction of its charted track slightly to the west of north is very remarkable. An examination of the weather charts of this office shows that during this period the barometer was

\* None of the Life-Saving stations on this coast are manned until December 1st. The nearest sea-coast station of the Signal service was at the Life-Saving station Kittyhawk, eight miles distant from the disaster. Information of the wreck was received there, through two fishermen, between ten and eleven a. m. A dispatch as follows was received at this office, at 11:35 a. m.: To the Chief Signal Officer, Washington, D. C., "U. S. steamer *Huron* struck two miles north of No. 7 Station, at 1:30 a. m.; foremast and main-topmast gone; steamer a total wreck; assistance needed immediately! The sea is breaking over her and several have already washed ashore drowned. Number on board, 135. No cargo." (signed) Naylor, Sergeant. A copy of this dispatch was immediately furnished for the information of the Secretary of the Navy and the Chief of the Life-Saving Service, by whom orders were at once telegraphed to the proper authorities. Instructions were sent from this Office, between 12 and 1 p. m., to keep open telegraphic communications, day and night, between Norfolk and Kittyhawk, and that a flag-man should be sent immediately to the scene of the wreck to open communication with the ship, or vessels aiding, and promptly

unusually high in the Middle States, New England and Nova Scotia, and that in general the centre of highest pressure was to the northeast of the centre of depression, while at no time does the barometer to the west and north of the storm appear to have been very high or to have risen rapidly or to have shown the usual diminution of temperature after the passage of the lowest pressure.

No. IX.—While the low area just described was in the West Gulf States another depression was entering Dakota and Minnesota. The centre of low barometer moved in an easterly track over Minnesota, and on the 21st passed beyond the northern limit of our reporting stations; it possessed no special features.

Nos. X and XI.—On the 20th and 21st there was an unusual fall of the barometer on the Pacific slope, and on the 22d there appears to have been an area of low pressure of great extent over the region north of latitude 35° N. and west of the Missouri river, and thence extending to the Pacific coast. On the afternoon of the 23d there appears to have been developed, from the low area just noted, two distinct centres of depression. The northerly depression, then central near Bismarck, has its track charted as No. X, and the southerly depression, then central in northern Colorado, has its track charted as No. XI. Low area No. X pursued on the 23rd and 24th an easterly track over Dakota and Minnesota, and on the 24th disappeared beyond and to the north of Lake Superior. Depression No. XI was, at mid-night of the 23rd, central in southern Colorado; on the 24th it moved with an easterly course into western Arkansas, developing, during the day, increased energy; on the 25th the storm had advanced in a northeasterly direction into southern Indiana, the barometer continuing to fall at the centre of the depression. At the end of this day an unusually high barometer in Nova Scotia barred the path of this storm to the northeast, while to the west and north the pressure was below the mean; under these circumstances, on the 26th, the storm-centre pursued a northerly path into the Upper Lake region. This was the second time during the month that a storm had been diverted to the north when a very high pressure stood to the northeast of the storm-centre, there being, at the same time, a deficiency in pressure to the north and west of the storm-centre, (see description of No. VIII.) On the 27th, the depression moved in a northeasterly track, beyond Lake Huron into Canada; during the progress of this storm, dangerous winds prevailed along the Atlantic coast, north of Cape Hatteras, and in the Lake region.

No. XII.—This is probably the storm reported by the Princess Beatrice as being near the Leeward Islands on the 23rd, 24th and 25th. On the afternoon of the 28th, in the South Atlantic States, there was a decided fall of pressure, and this fall taken in connection with the wind directions on that coast indicated a storm centre of considerable energy in or near the Gulf Stream and east of Florida. The fall of the barometer, and the backing of the wind along the Atlantic coast, shows that on the 28th and 29th this storm pursued a track slightly to the east of north until it is found at midnight of the 29th, central near Halifax. The next day it disappeared beyond Nova Scotia.

## INTERNATIONAL METEOROLOGY.

*Storms at Sea.*—The following notes of storms have come to hand: 13th, 26° 22' N., 58° 55' W.; hurricane 15th, 27° 02' N. 31° W., hurricane lasting until 7 a. m. of the 16th. 16th, 27° N. 52° W.; hurricane. 22d Haiton Island, Formosa Channel, China; typhoon. 28th, N. E. to S. E. hurricane, 34° 02' N. 76° 20' W. 6th off Cape Finisterre, S. W. hurricane. Nov. 2d, W. hurricane 50° 05' N., 20° 45' W. 6th, terrific northwest to southeast gale, 41° N. 64° W.; northwest hurricane. 49° 02' N. 32° 01' W.; hurricane 49° 33' N. 36° 47' W.; violent gales with hurricane squalls. 49° 15' N. 39° 02' W.; 47° 21' N. 43° 34' W.; 46° 23' N. 35° 18' W.; 47° 45' N. 33° 35' W.; 49° 38' N. 39° 53' W. 9th, violent gales with hurricane squalls, 49° 04' N. 29° 48' W.; 47° 19' N. 33° 38' W.; 49° 18' N. 41° 19' W. 10th, hurricanes, 46° 56' N. 43° 19' W.; 49° 33' N. 22° 82' W.; 48° 28' N. 33° 26' W.; gales, with hurricane squalls, 49° 14' N. 25° 37' W.; 47° 43' N. 36° 10' W.; 54° 36' N. 30° 08' W.; 49° 50' N. 16° 41' W.; 50° 45' N. 19° 12' W.; (fire ball exploded close to ship with loud report.); 43° N. 26° W. 12th, hurricane, 37° 30' N. 18° 40' W. 22nd, British Isles, gales, high tides and floods. 25th, British Isles, strong NE gale and floods.

forward all information to this Office. Sergeant Naylor—who had gone to scene of wreck in person, carrying medicines, &c.—returned to Kittyhawk at 6 p. m., and forwarded to this Office a report, giving all information he had obtained, number of officers and men saved, etc. A telegraph station was opened, before daylight of next day, abreast of wreck, where, during the day, flag-communication was had with the aiding vessels.

From that time there has been a telegraphic-station open at the scene of the wreck, where the number of messages received, relative to the wreck, up to December 11th, was two hundred and fifty-seven, and sent three hundred and four. During the severe storm then experienced on that coast, and since the telegraph lines of the Signal Service, from Norfolk to the wreck continued to work. The sea-coast telegraph of the Signal Service is used for the purpose of transmitting meteorological observations, for connecting Life-Saving stations or Light Houses, for giving notice of apprehended storms, by the display of signals, and information of shipwrecks. The line is constructed near the beach, so that a telegraph-station may be opened abreast of any wreck. All the stations are equipped with all that is required to open communication with ships in danger, in either the Signal Service or International Code.